Examining the Relationship between a Sophisticated Personal Epistemology and Desired Pedagogical Practices in Trainee Teachers

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Abstract

This paper demonstrates the key link between the development of a sophisticated personal epistemology and the concomitant emergent pedagogies of trainee teachers, as identified through research in this area, including empirical engagement with trainees on a PGCE primary teacher training course in the UK. The ensuing review of literature investigates the theoretical and paradigmatic perspectives and aims to theoretically underpin the methods used within the empirical research described. The conclusion is that it is of paramount importance that teacher training institutions allow for the development of exactly these sophisticated personal epistemologies through explicit teaching and exposure to the specific reflective practices discussed in order to promote the best possible outcomes in terms of trainees' pedagogical understanding and practices when immersed in authentic experiences in situated learning environments on school-based attachments, and retain appropriate levels of control over the contextual, environmental and experiential circumstances that their trainees encounter.

Keywords: epistemology, pedagogy, development, trainee teachers, pre service teachers

It is now generally accepted that social constructivist theories in teaching and teacher education are effective ways to theorise teaching and learning. As a lecturer in Primary Initial Teacher Education at a Higher Education Institution (HEI), my aim is for my trainees to leave with a clear understanding of the power of learning rather than teaching, and the pedagogical strategies to facilitate the learning of children rather strategies to 'merely' teach them. These values may be seen as the 'signature pedagogies of our profession' (Shulman, 2005). Shulman's central thrust is that trainees must come to understand in order to act, and they must act in order to serve.

At a cultural level, the members of the Primary Initial Teacher Education team at my HEI espouse the social constructivist view that knowledge is constructed socially through dialogue and experiential learning, and we would wish our trainees to understand our principles and to act them out in class-based realities in order to best teach children. Whilst not formally identified as such, much of the rhetoric of what we espouse is around the principles of Expansive Learning (Engeström, 2001): learning as participation; knowledge and skills being learned and/or produced that are not stable, not even defined or understood ahead of time; important transformations that are literally learned as they are being created. A key element is that learning is also seen as 'horizontal', through peer talk rather than from top-down 'delivery' methods, and is developed through boundary-crossing interactions (e.g. between two interacting activity systems, such as formal and informal learning methods, or theory-based and practical activities [see e.g. Akkerman & Bakker, 2011]), generally in socially-supported pathways. For this to happen, it is posited that intellectual skills and cognitive strategies such as problem solving or managing one's own learning require prior knowledge, guidance and application in other contexts (Bruner, 1967).

As a direct result of this, teachers are expected to facilitate student-centred learning by helping students to: construct knowledge in social contexts; engage with higher-order thinking rather than 'merely' reproduce knowledge; address real-world poorly-structured problems; and engage in collaborative learning, both with peers and with 'expert' tuition (Elen & Clarebout, 2001; Yang, Chang & Hsu, 2008). This current focus on learners as active agents in their own learning has emerged because we now have a better understanding of how teaching and

learning take place in social contexts and how knowledge construction is mediated by tools of technology (Windschitl, 2002). Children learn best experientially; and discovery is more meaningful and transformative than received wisdom. Meaningful learning is "active, constructive, intentional, authentic, and collaborative" (Jonassen *et al*., 2003, in Blaschke, 2012 p6). Learners need to be "active participants who articulate, reflect, and understand the relevance of what they learn" (Blaschke, 2012 p4).

Although these social constructivist approaches to teaching are thus advocated as good practice, many teachers are challenged by these approaches to teaching (Rosenfield, 2006) and traditional, teacher-centric approaches, which can be seen as transmissionist, or instructionist (Harel & Papert, 1991; cf. Schuh, 2004), often remain the default teaching practice (see e.g. Windschitl, 2002; Yang, Chang & Hsu, 2008). It can be baldly stated that, in order for teachers to engage in these practices, they need to have beliefs that support these approaches to teaching. Brownlee *et al*. (2011) argue that a specific type of teacher belief is under scrutiny here: these are the beliefs that teachers hold about the nature of knowledge and knowing which are referred to as *personal epistemology*. The phrase personal epistemology is used instead of *epistemological beliefs* because it reflects the individual, rather than philosophical, nature of these beliefs (Kitchener, 2002; Sandoval, 2005). Pintrich (2002) states that there is overall support for the notion that personal epistemology involve an individual's cognition about knowing and knowledge.

There is a wealth of literature on in service teachers and the links between their personal epistemologies and their teaching practices. For example, Maggioni & Parkinson (2008) completed a review of studies that specifically investigate the relationship between the two, and demonstrated that personal epistemologies are generally consistent with the observed teaching practice. This was borne out by studies on, amongst others, Taiwanese secondary teachers (Yang, Chang & Hsu, 2008), mathematics teachers (Muis, 2004), early years practitioners (Brownlee, 2000; 2001), and special education teachers (Jordan & Stanovich, 2003).

There is also evidence that beliefs and practices are not always consistent. Many *et al*.'s (2002) review of the literature shows that teachers may teach in ways inconsistent with their espoused epistemologies and pedagogical beliefs (see also Vacc and Bright, 1999; Wilson and Cooney, 2002). Espoused beliefs should not therefore be considered as predictors of genuine classroom practice. They are not necessarily deliberately disingenuous, but may be considered as representative of intentions rather than actions (Feiman-Nemser *et al.*, 1987; Fosnot, 1989). These intentions may not suit a reality which bears little or no resemblance to the envisioned situation and experiences for which the original intentions were created (Cooney, 1985; Karaagac & Threlfall, 2004, both in Liljedahl, 2008). Other studies that bear this out include Lee & Tsai (2010) and Schraw, Olafson & Van der Veldt (2011). Argyris and Schön (1974) mark the distinction between an individual's practice and espoused pedagogies with the terms 'theory-in-use' and 'espoused theory'. That there is also a clear gap between the two in *pre service* teachers, regardless of the level of sophistication of their personal epistemologies, is attested to by such studies as Olafson *et al*. (2010), Ozgun-Koca & Sen (2006) and White (2000).

A full review of the literature in this fast-growing field (Hofer, 2004) is well beyond the limits of this paper. As Greene (2007) notes, however, studies from the areas of educational psychology, philosophy and developmental psychology must all be included in order to better understand epistemic cognition, as well as studies – both theoretical and empirical – from the fields of educational research to better comprehend its role in pedagogical practice.

The study of personal epistemology itself still defies concrete definition and scope (Hofer & Pintrich, 1997; Kitchener, 2002), thus allowing for a large range of models, frameworks and perspectives, rendering the task of a review all the harder. Hofer (2004a, 2004b) notes that a range of paradigms for understanding and studying personal epistemologies is evident in the research literature in this field. These paradigms allow researchers to develop "rich understandings about how to promote effective learning and, to a lesser extent, effective teaching in a range of educational contexts" (Brownlee *et al*. 2011 p5). These paradigms include *epistemological development*, *epistemological beliefs*, *epistemological theories*, *epistemic met cognition* and *epistemological resources*. I will discuss each of these briefly, but for the purpose of this review I decided not to categorise the literature in the field as Greene (2007, building on Perry, 1999) proposed, but rather into four paradigmatic fields, based initially on Pintrich's 2002 system of three broader ways of researching personal epistemology: the cognitive developmental approach (*epistemological development*), the cognitive approach (*epistemological beliefs, epistemological theories, epistemic meta cognition*), and the contextual approach (*epistemological*

resources). The key difference is that I have split the cognitive approach into separate sections on beliefs and theories, following Brownlee *et al*. (2011).

Throughout this paper I will follow Brownlee *et al*.'s definition of personal epistemology as both set within the context of teaching and teacher education, and as meaning the teachers' understanding of and cognition about knowing and knowledge, regardless of the paradigm on which the research is based (Ibid, 2011 p7). Much of the extant literature on personal epistemology refers to studies that have taken place in academic contexts (Schraw & Sinatra, 2004) and there is an academically-robust body of research that shows how personal epistemologies influence student learning. Kang (2008) asserts, however, that little research has investigated the relationship between personal epistemologies and teaching, and Feucht (2009) states that there is even less in the specific field of teacher education. Hofer (2010) has recently expressed concern that we still lack research evidence in the area of personal epistemologies and teaching practice. In the following paragraphs I present the current state of research as seen through the four paradigms I described earlier.

The first paradigm is that of *epistemological development*: how a range of education contexts influence the development of personal epistemology (Hofer, 2004a). The formative work of Perry (1970) and King & Kitchener (1994) showed that an individual's worldview can develop from simplistic to more complex, evidence-based understandings. Kuhn & Weinstock (2002) have, more recently, discussed developments in personal epistemology that demonstrated a particular trajectory: absolutist – subjectivist – evaluativist. In their view, individuals can be seen as moving from simplistic, absolute views of knowledge where there is little reflective cognitive behaviour as issues are seen as black-and-white, through to an understanding that personal opinions have a bearing on understanding but knowledge itself, whilst to some degree a personal construction, is received and "largely unexamined". The final, evaluative, stage is characterised by an understanding that some knowledge is 'better' than others and thus any claims to knowledge need to be made after evaluating a range of different theories and perspectives and tentative conclusions made as to the best understanding and its concomitant response. Pintrich (2002) points out that the terms commonly used by the research community to label these different epistemologies are *naïve* and *sophisticated*, terms to which I shall return throughout this paper. There were a number of models of this understanding of epistemological development created and discussed in the 1980s, generally inspired by Piagetian developmental psychology (Brownlee *et al*., 2011).

These have been built on by the models advanced in the 1990s (see e.g. Schommer, 1990) that this is too simplistic a framework – that the described stages are too rigid and cannot adequately explain something so fluid as the transitions it attempts to describe – and that, instead, we should comprehend this field through the lens of *epistemological beliefs*, which postulates that personal epistemology consists of a set of independent, multidimensional and potentially self-contradictory beliefs (see e.g. Schommer-Aikens, 2004). Brownlee *et al*. (2011) give the example of an individual who simultaneously holds a naïve belief about the certainty of knowledge but the more sophisticated understanding that it is a personal construct.

However, there is another body of research that describes personal epistemology as more than this: the research that comprises the field of *epistemological theories* conceptualises personal epistemology as comprising both general and domain-specific theories, for example an individual may have a naïve or general understanding of knowledge itself but a sophisticated comprehension of, for example, mathematics. Hofer (2004a), building on Kitchener (1983), has further developed this theory in order to label and define an emergent field as *Epistemic meta cognition*, in which an individual's personal epistemology is seen as the previously-defined set of domain-general and domain-specific theories acting meta cognitively – without conscious thought.

These meta cognitive operations are also seen as contextually, culturally and educationally influenced by the local environment in which they interact: "situated in practice and activated in context" (Hofer, 2004a p 46). Subsequent researchers have expanded this paradigmatic framework. Whilst at first glance it seems a return to the ideas of the 1980s, it focuses rather on generalistic theories of knowledge that can be found anywhere along a continuum of naïve to sophisticated world views. Theorists who explore this field through this paradigm, such as Bendixen & Rule (2004), and Olafson, Schraw & Van der Veldt (2010), describe an individual's personal epistemology as comprised of "multiple beliefs that develop together as an integrated set of beliefs that comprise a unified belief system" (Brownlee *et al*., 2011). Schraw & Olafson (2008) contrast epistemological worldviews with ontological worldviews as they assert that an individual's beliefs about knowledge are not necessarily related to their beliefs about the nature of reality and being. Others (Brownlee, Purdie & Boulton-Lewis, 2001; Brownlee & Berthelsen, 2006) have described a more inclusive theoretical understanding with the term *personal*

epistemology, through which they see an individual's epistemological worldview as comprising all one's "beliefs, attitudes and assumptions about the acquisition, structure, representation and application of knowledge" (Brownlee *et al*., 2011). Although there is limited research evidence in the area of personal epistemologies and teaching practice, what there is seems to suggest that links between personal epistemologies and practice may be moderated by the broader teaching and learning environments (Johnson, Woodside-Jiron & Day, 2001; Kang & Wallace, 2005).

Further work has led to the final of these theoretical perspectives: that of the *epistemological resources* paradigm. This was first espoused by Hammer & Elby (2002), and describes an individual's epistemology as a set of context-specific 'resources' that will allow a personal to adjust their epistemological lens to the task(s) at hand. A key way of understanding this is to envision personal epistemologies as individually adaptable and variable both between and within individuals, dependant on the context in which they are present. This paradigm has been summarised by Louca *et al*. (2004) as the concept of epistemology being characterised by context-specific resources rather than developmental stages: the idea that ways of knowing the world can vary according to the environmental context.

There is some more recent literature that makes varied attempts at unifying two or more of these theories together into a hybrid tool for analysis in order to study elements of personal epistemology (see e.g. Feucht, 2011; Schraw *et al*., 2011). However, none of these make any concerted effort to tie their contributory theories into a unified explanatory guide to the study of neither personal epistemology, nor goes far enough in adopting each of the paradigms discussed above into a single unified whole. Whilst seeing the attraction of such a goal, I here contend that more research in this area is needed and I feel secure in leaving such studies out of my present review of the extant literature.

From my studies in this area, I present Figure 1 (following page) as a synthesis of the findings of the key literature discussed so far as it pertains to the three-way construct of the conceptual frameworks discussed, the personal epistemology of preservice teacher trainees, and the impact of this on their pedagogical practice in "real-world situations" (Eberle & Childress, 2007; McAuliffe *et al.*, 2008).

From this table it is clear to see that there is no clear consensus about a definition for the term, or parameters for the study of, personal epistemology. Strengths and weaknesses can be identified in all the four frameworks that I have chosen to subgroup the literature under. I argue here for the idea of individuals' developing epistemological sophistication not as a series of definable stages but as a continuum on which individuals can be pinpointed at a certain moment but along which they may move in either direction dependant on contextual, environmental and experiential circumstances.

Implications For Pre service Teacher Trainees

Muis (2004) presents strong evidence that an individual's personal epistemology influences learning strategies and learning outcomes in pre service teachers: the more sophisticated the epistemology, the more appropriate the strategies used and the more effective the learning. Ravindran, Greene & DeBacker (2005) provided evidence that personal epistemologies may influence goal-setting, which then impacts on the approach to learning that is used. Results from their studies showed that more sophisticated personal epistemologies were linked to meaningful approaches to learning and mastery goals.

There is a growing body of research (Yadav & Koehler, 2007; Many, Howard & Hoge, 2002; Muis, 2004; Peng & Fitzgerald, 2006) that suggest that personal epistemologies may filter how preservice teachers experience learning in teacher education courses and engage in meaningful approaches to learning. Bråten & Strømsø (2006b) demonstrated how first-year preservice teachers' personal epistemologies about the speed of knowledge acquisition influenced their capacity to engage in critical thinking, and a separate study showed that students with sophisticated personal epistemologies demonstrated better comprehension when reading conflicting texts about a single subject (Bråten & Strømsø, 2006a). This study, alongside Bråten, Strømsø & Samuelstuen (2008) and Peng & Fitzgerald (2006) demonstrate how various dimensions of personal epistemologies may differentially influence learning outcomes in terms of text comprehension. The social constructivist theories of learning and knowledge-creation are those that most deeply influence writing in this field, but particularly the literature that I have labelled as epistemologically theoretical. Ramsden (2003 in Thompson, Pilgrim & Oliver, 2005), for example, describes

Author(s)	Conceptual framework	Implications for epistemology	Impact on learning/ pedagogical practice
Perry	**Developmental**: a shift from absolutist to evidence-based ways of knowing	Development is dynamic, and learners are always in flux	Exposure to cognitive disequilibrium leads to movement along the continuum towards relativism
King & Kitchener	**Developmental**: levels of reflection: from prereflective – quasi-reflective – reflective	Movement through the developmental stages occurs through interaction with the environment and construction of personal meaning	Exposure to ill-structured problems leads to higher-order, evaluative thinking
Schommer	**Beliefs**: multidimensional beliefs that may be simultaneously naïve and sophisticated	Links between epistemology, self-efficacy and self-regulation	Dilemmas faced by teachers are resolved in different ways based on personal epistemologies
Hofer	**Beliefs**: 4 beliefs subsumed under 2 general dimensions: *the nature of knowing* and *the process of knowing*	Numerous independent factors that comprise and influence an individual's personal epistemology: these beliefs affect what they set out to learn and how successful they are	The more learners reflect on their personal epistemologies, and the more sophisticated they are, the greater learning potential they have
Schraw & Olafson	**Theories**; multiple beliefs that develop together that comprise a unified belief system	Discussion and reflection aimed at calibrating beliefs and practices	Realist beliefs relate to direct instruction; relativist to learner-centrism and constructivist teaching
Kuhn	**Developmental**: realist – absolutist – multiplist – evaluativist	Epistemological maturity is a balance of subjectivity and objectivity	Critical thinking is vital in as a means of establishing justification
Brownlee *et al*.	**Developmental**	Social reflection on practice leads to ownership and deeper comprehension of personal beliefs	Sophisticated beliefs lead to constructivist practices; naïve beliefs lead to instructionist transmission
Schwartz & Jordan	**Personal**: individuals identified as on a continuum between *pathognomonic* and *interventionist*	Promotion of awareness of theories that underpin knowledge, teaching, and learning.	Interaction with students will impact on teacher attitudes and empathy
Bendixen *et al*.	**Theories**: multiple beliefs that develop together that comprise a unified belief system	Use of specific reflective tasks to increase awareness of beliefs	Unspecified
Marra & Palmer	**Developmental**: individual beliefs across multiple developmental stages	Collaborative reflection and discussion of beliefs on pedagogical choices: deeper comprehension	Discursive reflective and collaborative outcomes
Baxter Magolda	**Developmental**: Levels of reflection: from absolute – transitional – individual – contextual	Construction of meaning from environment and experience allows individuals to form and re-evaluate their epistemological assumptions	A balance between disequilibrium and commitment to one's own beliefs and sense of self required for learning
Hammer & Elby	**Resources**	Epistemology as context-specific rather than developmental stages: learners can hold two views and use the relevant one where necessary	Learners can both take instruction from authority yet construct their own knowledge
Bråten & Strømsø	**Beliefs**, following Hofer	Dimensions of personal epistemology influence learning outcomes – more sophisticated leads to greater comprehension	Reflection through direct discussion of conflicting beliefs, with the aim of aligning beliefs and practices
Tabak & Weinstock	**Developmental**, based on absolutist, multiplist and evaluativist stances	Differing stances on pedagogy lead to very different outcomes	Relativist epistemologies promote constructivist teaching and higher student autonomy, widening perspectives of both
Pintrich	Overview of all frameworks	Naïve – sophisticated belief trajectory	Not discussed
Ramsden	**Theories**	Based on weaker or stronger acts of constructivism	Stronger acts help students to use deep-holistic approaches to learning
Yadav *et al*.	Overview of the **developmental**, **beliefs** and **theories** paradigms	Relativistic nature of education: further longitudinal study needed	Personal epistemologies related to practice, but results inconclusive across literature

Figure 1: Synthesis of research

what he calls "deep-holistic learning strategies" – building on personal meaning and organising ideas so that links are made to prior knowledge, connecting ideas and evaluating a range of evidence (critical thinking).

This is in opposition to surface-atomistic learning (surface meaning with few interconnections made between topics). This has been described by Windschitl (2002) as *strong* and *weak* acts of constructivism. Where teachers promote strong acts of construction with their students, they help students to use the deep-holistic approaches to learning and to build personal meaning. This is characterised by experiential learning, evaluative strategies, collaboration with teacher and peers, and the use of high-order thinking skills (Elen & Clarebout, 2001; Yang, Chang & Hsu, 2008). Teachers who promote weak acts of construction create conditions that only allow for surface-atomistic approaches to learning. These are characterisable by teacher-centric, didactic practices, and imitative activities rather than engagement, which can lead to the reproduction of information without necessarily demonstrating personal understanding. It is in allowing trainees to "surface and examine their beliefs and assumptions" (Feiman-Nemser *et al*., 1989 p1) and, as a logical extension, their subsequent actions, and to help them engage with reflection that we as teacher educators can help to develop their epistemologies and thus their practices.

From that material I have labelled epistemological beliefs, it can be seen that sophisticated personal epistemologies are related to meaningful approaches to learning (Bond y*et al*., 2007; Brownlee, Berthelsen & Boulton-Lewis, 2004). Bondy *et al*. report that students with sophisticated personal epistemologies (defined as seeing that knowledge is uncertain and integrated) were more likely to be open to multiple perspectives and to see the interconnections between ideas. Schraw& Sinatra (2004) note that teachers with more sophisticated personal epistemologies are likely to be quite adaptable in terms of teaching strategies and engage more with their students. Weinstock and Roth's (2012) study shows how teachers' personal epistemologies are related to their predilections for teaching student autonomy. Tabak & Weinstock (2008) demonstrate that teaching practices related to inquiry teaching can cultivate certain personal epistemologies in children. These studies all reinforce the notion that naïve personal epistemologies are related to weaker acts of constructivist teaching whereas sophisticated personal epistemologies are linked to strong acts of constructivist teaching (cf. Windschitl, 2002).

Chai, Khine & Teo (2006) assert that preservice teachers' personal epistemologies are related to beliefs/conceptions regarding teaching rather than their actual teaching practice, which reinforces my earlier point about espousal not necessarily being an indicator of practice. Cheng *et al*. (2009) demonstrated that sophisticated personal epistemological beliefs were found to be related to constructivist conceptions of teaching in preservice teachers just as in in-service staff. Tsai & Liang (2009) found that those with more sophisticated personal epistemologies were more able to listen to and respond effectively to peer feedback and – importantly – to develop more creative, enjoyable and relevant activities. Brownlee *et al*. (2011) show clear links between sophisticated personal epistemologies and child-centred, constructivist teaching interactions. Kienhues, Bromme & Stahl (2008, in Brownlee *et al*., 2011 p14) contend that teacher education needs to promote sophisticated personal epistemologies not only because of the links between these and meaningful learning but also because a "knowledge economy requires sophisticated approaches to knowing."

There is a large body of research to support the view that explicit reflection on personal epistemologies may encourage changes in such beliefs. The majority of studies of the personal epistemologies of preservice teachers conclude with a key recommendation for teacher education programmes that personal epistemologies should be an explicit focus on those courses and that students should be encouraged to engage with specific reflection on their beliefs (see e.g. Bondy *et al*., 2007; Buitink, 2009; Cady, Meier & Lubinski, 2006; Chai *et al*., 2006; Chan, 2004; Cheng *et al*., 2009; Liu & Tsai, 2008; Kang, 2008; Silverman, 2007; Tsai and Liang, 2009; Yilmaz-Tuzun & Topcu, 2008). Hobson *et al*. (2008) add that their findings in their review of the literature support recommendations for teacher educators to assist their trainees to 'surface and examine their initial beliefs and assumptions' (Feiman-Nemser *et al*. 1989 p1; cf. Fosnot 1996; Edwards and Ogden 1998; Hobson *et al*. 2006). This is echoed by Maggioni & Parkinson (2008) who note that effective teachers explicitly "direct students to what counts as knowledge and appropriate ways of obtaining that knowledge in the specific situation" – a practice they label "epistemological moves" (Maggioni & Parkinson, 2008 p453).

In studies where explicit reflection on preservice teachers' personal epistemologies has been promoted there is clear evidence of an effect on these epistemologies (Valanides & Angeli, 2005). It was shown that those who

engaged in reflection experienced a greater change in personal epistemology than those who had merely completed the tasks. If preservice teachers are encouraged to reflect on their epistemologies at a metacognitive level they could attain more sophisticated views about the nature of knowledge (Brownlee, Purdie &Boulton-Lewis, 2003; Brownlee, 2004).

The personal epistemologies of preservice teachers also seem to be related to their approaches to learning (Brownlee &Berthelsen, 2006; Chan, 2003), teaching goals and strategies (Hashweh, 1996; Kang, 2008) and their teaching practices (Tsai, 2003). Whilst there is an overwhelming consensus that preservice teachers need to reflect on their personal epistemologies and the nature of critical thinking, it is less clear what methods should be used, or will achieve the greatest results. Brownlee *et al*. (2011) discuss calibration, drawing on the work of Cunningham *et al*. (2004), Maggioni & Parkinson (2008) and Stahl *et al*. (2006). This is the idea that "well-calibrated teachers know what they do and do not know and can therefore seek knowledge in areas that need improvement" (Maggioni & Parkinson, 2008 p454). Stahl *et al*. (in Maggioni & Parkinson, 2008 p455) describe how individuals with sophisticated personal epistemologies were "more able to calibrate their goal setting and planning to the difficulty of the task". It is the conclusion of Brownlee *et al*. that preservice teachers need to "engage in explicit reflection on their own personal epistemologies to come to an understanding of them, and then to be shown how to calibrate these personal epistemologies to various teaching contexts" (Brownlee *et al*., 2011 pp15-6).

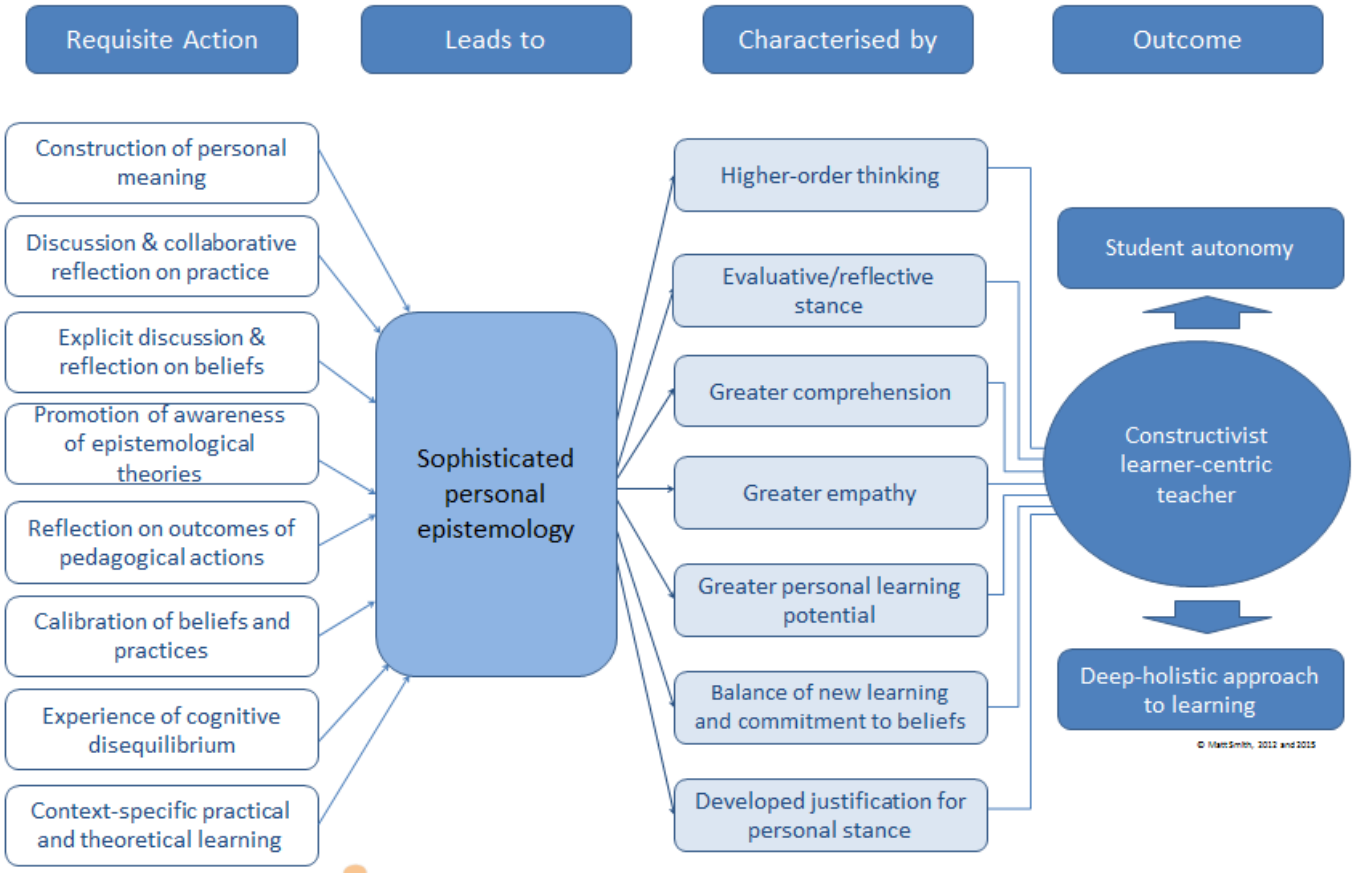

Figure 2: the relationship between a sophisticated personal epistemology and constructivist teaching practices

Figure 2 explains my understanding of how a sophisticated personal epistemology leads to a more constructivist approach to teaching which, as will be remembered from the beginning of this paper, is commonly held to be a desired outcome by instructors on Primary Initial Teacher Education courses. I therefore maintain that it is

important that we, as teacher trainers, allow for the development of exactly these sophisticated personal epistemologies through explicit teaching and exposure to the specific reflective practices mentioned in order to promote the best possible outcomes for the children our trainees will go on to teach in their subsequent careers.

Conclusions and Implications for Teacher Training Institutions

It would be difficult to argue that the development of sophisticated personal epistemologies for those who attend is a desirable outcome for goal for teacher education programmes; however it is reportedly often the case that undergraduates who finish their courses and enter the profession still hold relatively naïve personal epistemologies. "Clearly, in these circumstances, teacher education programmes are not helping teachers to develop the more sophisticated personal epistemologies needed for teaching" (White, 2000 in Brownlee *et al*. p7). This, in part, has been a driver for my own research.

In conclusion, I offer two potential interventions that I propose will give teacher training institutions a greater likelihood of promoting sophisticated personal epistemologies amongst their trainees which will, as described above, lead to better outcomes for teaching and learning.

The first is double-barrelled, and follows Schraw *et al*. (2010):firstly, to specifically allow pre service teachers to develop a greater understanding of their own views on knowledge and learning by introducing them to theories that enable them to think ontologically and epistemologically and to investigate the links between their worldview, their developing understanding of learning and teaching, and their pedagogical practices; and secondly, to initiate and sustain reflective and discursive practices throughout the length of teacher training courses. Where my own B.Ed. Y2 and PGCE trainees have been required to complete individual reflective portfolios on collaborative learning group tasks that specifically insist on their discussing, describing, and reflecting on, the processes that they have been through and the pedagogical choices made rather than merely the outcomes of the tasks, they have exhibited three key outcomes (Smith, 2015).

- Better performance in tests on the material: pedagogically-contextualised learning being recognised as having a clearer effect on understanding than discrete information for trainee teachers – see e.g. Guerra-Ramos *et al*. (2010) who state that a more sophisticated and nuanced understanding is elicited in response to questions that are grounded in pedagogically-relevant contexts rather than discrete ones;
- Better outcomes on teaching practice, as they were able to draw on a more sophisticated personal epistemology in order to create better learning in the classrooms, as exemplified by Figure 2; and
- Greater enjoyment: trainees have stated that they have enjoyed and gained more from this reflective and process-driven technique than from more standard task-based learning. The module feedback was overwhelmingly positive (98% Outstanding or Good).

A clear implication of this is that this model of socially-constructive, collaborative, facilitated, exploratory and reflective practice that has worked well in the context of primary initial teacher education through investigating processes as well as outcomes and has had a demonstrably successful track record in allowing trainee teachers to explore and develop their personal epistemological viewpoints, leading to better outcomes for themselves and for children's learning should be instigated, developed and sustained on teacher education courses.

The second intervention that I propose is that HEIs need to retain relative control over the contextual, environmental and experiential circumstances that trainees will encounter. Teaching attachments should be accurately mapped so that trainees are given an opportunity to develop by working with mentors with different teaching styles in order to force them to face conflicting messages and to decide on their own epistemological, and therefore pedagogical, stances when working in ill-defined contexts (cf. Yadav & Koehler, 2007). Likewise, opportunities should be mapped through the length of teacher education courses that promote the growth and development of personal epistemologies through the provision of the reflective, collaborative and constructivist experiences and tasks described above.

Taking these two interventions together will, I believe, allow for the development of sophisticated personal epistemologies which will lead to socially-constructive and effective teaching practices through a 'calibration' of epistemological beliefs with pedagogical practices. '*Tis a consummation devoutly to be wish'd!*

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